

CHAPTER K

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K.00 General

This chapter includes all work performed on highway electrical facilities used for control of traffic with traffic signal systems, highway and sign lighting systems, toll bridge electrical systems, Intelligent Transportation Systems (ITS), count stations and other related systems.

The general objective of this program is to maintain all highway electrical facilities described above to ensure reliable electrical systems and service.

The Maintenance Program or District Maintenance unit will not affect any permanent changes or modifications that will change the operational characteristics of an electrical facility without prior approval in writing from the Traffic Operations Program or District Traffic Operations unit or other appropriate Department Branch.

The California Highway Patrol (CHP) or local police are authorized to place a traffic signal on flash or turn it off to direct traffic in the event of any emergency, to expedite traffic, or to ensure safety as conditions may require notwithstanding any provisions of the Vehicle Code.

Damaged or malfunctioning electrical installations which seriously affect public safety or capital investment should be highest priority in electrical maintenance for repair or temporary corrections until permanent repairs can be scheduled. Lower priority should be given to repair of inoperative or damaged electrical installations, which do not seriously affect public safety.

Refer to Volume 2 of the Maintenance Manual for administrative details covering the "K" Family Electrical Program.

K.01 Levels of Service

Refer to Volume 2 of the Maintenance Manual for Levels of Service covering the "K" Family Electrical Program.

K.02 Highway Lighting and Sign Illumination

Highway lighting and sign illumination is provided to improve visibility during darkness and to promote safe and efficient use of special roadway facilities.

Maintenance of highway lighting and sign illumination is the preservation of the facility in the safe and usable condition to which it has been improved or constructed.

K.02.1 Night Lighting Inspection

Highway lighting and sign illumination should be inspected at night for proper operation once each month. Electrical Outage Worksheets, or some other recording device, should be used to list each outage by County, Route, Post Mile and Pole Number. Lighting standards knocked down each month and illuminated street name sign outage should also be recorded on this form.

A monthly report shall be sent to Headquarters Electrical Maintenance detailing the number of outages as a percentage of the total inventory by the 15th of the following month.

K.02.2 Luminaires

Luminaires should be thoroughly inspected at the time of lamp replacement, and the following points checked:

- (A) Gaskets--Inspect for loose or missing gaskets. Repair or replace as required.
- (B) Glassware--Inspect for cracked or broken glassware. Replace if necessary.
- (C) Hardware--Apply suitable thread lubricant to hardware item which must be removed in the course of routine maintenance.
- (D) Terminal Block--Inspect for cracked or broken barriers on the block. Replace if necessary.
- (E) Mounting--Inspect to determine if luminaire is rigidly held in proper position. Make any adjustments necessary.
- (F) Sockets and Receptacles--Inspect for burned current carrying parts and broken insulation. Replace if necessary.
- (G) Wiring--Inspect for abrasions which might develop shorts or grounds, and repair as required.
- (H) Reflectors--Inspect for scum or tarnish. Replace if necessary.

K.02.3 Photoelectric Controls

Photoelectric controls should be checked during routine lighting inspection, serviced periodically or replaced as required.

Attention should be given to coordinating controls to ensure that all highway lighting units turn off or on at approximately the same time within an interchange or closely spaced interchanges.

Circuits designed for early turn on of illuminated signs should have the early turn on type of photocells. When these photocells fail, it is important that they are replaced with the correct unit. See Standard Specifications for correct turn off and turn on settings.

K.02.4 Luminaire Ballast Fusing

Where primary lines of multiple ballasts, are provided with fused splice connectors, fuse ratings should be as shown on the Standard Plans.

K.02.5 Relamping

Lamp outages noted on the monthly night lighting inspection should be scheduled for replacement as soon as work load permits.

All lamps should be group replaced on a planned schedule based on the rated lamp life, which is published by the manufacturer. Lamp life is based on life tests of the particular lamp operated at rated voltage and current. Group replacement has several advantages. It reduces the frequency of outages, thereby lowering the cost of maintenance, and illumination is kept to near initial levels.

Typical group relamping schedules based on current rated life are as follows:

- | | |
|--------------------------|----------------------------|
| (A) Mercury | Group relamp every 4 years |
| (B) High Pressure Sodium | Group relamp every 4 years |
| (C) Low Pressure Sodium | Group relamp every 3 years |
| (D) Fluorescent | Group relamp every 2 years |

Accurate records should be kept indicating group relamping dates and location.

K.02.6 Sign Lighting Fixtures

Malfunctioning fluorescent sign lighting fixtures may be replaced with mercury sign lighting fixtures provided the Traffic Operations Program or District Traffic Operations unit concurs.

Use fixtures specified in the Standard Specifications and use fixture spacing charts as shown in Standard Plans.

With this change, relamping will be extended from 2 years to 4 years.

K.02.07 Lighting Standards and Mast Arms

Lighting Standards and mast arms should be inspected periodically for loose bolts and nuts. The inspection period should be the same as the relamping period at the minimum, or more often as outage repairs are performed.

Missing hand hole covers should be replaced.

Lighting standards with slip bases or slip base inserts should be inspected periodically to ensure the slip bases or slip base inserts will function properly under the impact of collision.

In particular, attention should be given to:

- (A) Soil erosion, damage, or dirt build-up around the pullboxes or foundations of the standards.
- (B) Excessive growth of grasses or bushes near the pullboxes or standards.
- (C) Any obstacles that will interfere with the operation of the slip bases or slip base inserts.

K.02.8 High Mast Lighting

In addition to the steps outlined in the previous paragraphs, special maintenance procedures have to be followed when working with high mast equipment. These procedures deal primarily with the design of the mechanical hoisting mechanism components, which provide for the luminaires to be lowered and raised. Manufacturers of high mast equipment use different designs, so only general maintenance recommendations applicable for all types of equipment can be given. To assure the proper, long, and trouble-free life of the equipment, follow the steps outlined in the manufacturer's maintenance literature closely.

Listed below are steps of a general nature, which serve as a general overview of maintenance requirements, which should be accomplished.

- (A) Winch
 - (1) Remove any dirt or foreign matter which may have accumulated on top of the winch or on the wire cables and clean thoroughly.
 - (2) Check oil in oil bath and add or change if excessively thick and/or dirty.

- (3) Check all bearings and lubricate if required.
- (4) Powerdrive the lowering device through its full length of travel and visually inspect for undue wear on the winch mechanism.

(B) Cables

- (1) Inspect the cablelay on the winch and the section of cable visible at mast door opening for frays, kinks, or corrosion.
- (2) Inspect winch cable throughout its length for frays, kinks, or corrosion.
- (3) Inspect anchorage points of winch cable on winch and of hoisting cables at luminaire supporting ring.
- (4) From the base of the mast, observe hoisting cables from luminaire support ring in lowered position to masthead for any obvious defects.

(C) Luminaire Ring

The Luminaire Ring should be lowered approximately every 6 months and inspect the following:

- (1) While lowering the ring, make sure the roller contacts of the centering arms are in contact with the pole throughout the entire length of travel.
- (2) Inspect the spring of the centering arms for corrosion, clean and lubricate if required.
- (3) Inspect guide rollers (where fitted) and lubricate and adjust as necessary.
- (4) Inspect interconnecting cables and junction boxes for damage and repair as necessary.
- (5) Inspect electric power supply cable anchorage, sockets, connectors and inspect cable for physical damage.
- (6) Inspect and tighten all nuts and bolts if necessary.

(D) Foundation Bolts

- (1) Check foundation bolts, and tighten nuts where necessary.

K.03 Toll Bridge Electrical Maintenance

Periodic inspections of toll bridge electrical systems listed below are essential to observe and correct potential deficiencies before serious problems develop.

(A) High Voltage Power Distribution Switch Gear and Cables

- (1) A detailed inspection and operation of switch gear should be semiannual.
- (2) Cables should be meggered annually.
- (3) Cleaning of equipment should be as required.
- (4) Maintenance levels should be performed as recommended by the manufacturer.

(B) Fire and Security System

- (1) Inspect and test monthly.
- (2) Repair as needed.

(C) Bridge Air Supply System

- (1) Inspect and service as recommended by manufacturer.
- (2) Megger motors annually.

(D) Fire Hydrant Booster Pumps

- (1) Test and inspect monthly.
- (2) Megger motors annually.
- (3) Service as recommended by manufacturer.

(E) Traffic Metering System

- (1) Should be routinely inspected for proper operation consistent with good maintenance practice.
- (2) Should be group relamped every 2 years.

- (3) Repair as needed when reported by Bridge Dispatcher.
- (F) Auto Call System
 - (1) Check and test monthly.
 - (2) Service transmitters quarterly.
- (G) Toll Collection System
 - (1) Monthly check and service on the mainframe as recommended by Hewlett-Packard.
 - (2) Replace the absolute and pre-filter units every 3 months and log record of maintenance.
- (H) Lane Console
 - (1) Check backup tapes weekly. Replace if required.
 - (2) Perform monthly preventive maintenance on the operator's control panel and processor section.
 - (3) Replace filter every 30 days and vacuum dust from inside the console assembly.
 - (4) Complete lane maintenance procedure to be accomplished at least once a year including cleaning of electronic board contacts.
- (I) Standby Emergency Power Systems
 - (1) Inspect Weekly and Service as needed.
 - (a) Fuel level
 - (b) Oil and water levels
 - (c) Battery
 - (d) Belts and hoses
 - (e) Leaks of water, oil and fuel

- (2) Test Run Weekly
 - (a) Check Frequency - 60 cycles
 - (b) Check output voltage
 - (c) Check starting system
 - (d) Transfer time delay relay
 - (e) Transfer contactor
 - (f) Check shutdown system
 - (g) Shut down delay relay
 - (h) Shut down contactor
 - (i) Inspect all gages for correct readings
- (3) Log all Readings on Generator Test Form

K.04 Traffic Signals--Definition

Traffic control signals are power-operated traffic control devices, which alternately direct traffic to stop and to proceed at highway and street intersections. Their purpose is the orderly assignment of right-of-way to the various traffic movements.

K.04.1 Legal Authority

Section 21350 of the Vehicle code authorizes the Department of Transportation to place and maintain appropriate signs, signals and other traffic control devices as required to warn or guide traffic upon the highways. A permit is required for the erection by others of traffic signals and flashing beacons, on all State highways, whether within incorporated or unincorporated areas.

See Chapter Y: Work for Others

K.04.2 Traffic Signal Timing and Operations

Initial timing of traffic signals and any subsequent changes in timing shall be the responsibility of the Traffic Operations Program or District Traffic Operations unit. Maintaining the timing is the responsibility of the Maintenance Program or District Maintenance unit. Temporary timing changes can be made by the Maintenance Program or District Maintenance unit to compensate for sudden changes in traffic conditions or malfunctioning traffic signal equipment that cannot be repaired or replaced immediately. The Traffic Operations Program or District Traffic Operations unit must be notified of any temporary timing changes as soon as possible. Signal Timing Forms will be prepared and furnished by the Traffic Operations Program or District Traffic Operations unit and a copy sent to Maintenance Program or District Maintenance unit. Signal timing records should be kept by both the Traffic Operations Program, or District Traffic Operations unit and the Maintenance Program, or District Maintenance unit.

Any observed timing or operational traffic signal problems should be promptly reported to the Traffic Operations Program or District Traffic Operations unit.

K.04.3 Emergency Mode of Operation

The emergency mode of operation for all traffic signals shall be flashing operation.

K.04.4 Traffic Signal Records

Adequate office records are a necessary function of the signal maintenance organization.

Office records should include the following types of statistical data:

- (A) Type and number of traffic signals
- (B) Lighting equipment at each location
- (C) Date of installation
- (D) Type and date of all trouble calls
- (E) Who reported the trouble
- (F) Who repaired, and extent of the repairs

A monthly report shall be sent to Headquarters Electrical Maintenance detailing the number of inspections performed and overdue as a percentage of the total inventory, by the 15th of the following month.

The Traffic Operations Program or District Traffic Operations unit, which approves signal installations and generally prepare the specifications, would like to be informed on any operating difficulties encountered with any type of equipment or equipment from a particular manufacturer. With this information they can change or revise the specifications on some types of equipment to eliminate any defects or eliminate use of equipment from that manufacturer.

K.04.5 Maintenance of Traffic Signals

A detailed check should be at 60 day intervals for proper operation of controller assemblies and signals. This check should include the following items:

(A) Field Inspection

- (1) Visual check of indications
- (2) Vehicle and pedestrian head alignment
- (3) Pushbutton operation
- (4) Hardware (Hand-hole covers, signs, poles, backplates, etc.)
- (5) Pullbox covers (Broken, missing, and clear of dirt or debris)
- (6) Condition of street name signs
- (7) Visual check of service cabinet and equipment locks
- (8) Traffic handling of intersection
- (9) Visual check of loops in roadway

(B) Cabinet Interior

- (1) Controller unit indicator lights
- (2) Function and timing
- (3) Detector indicator lights
- (4) Check flasher outputs
- (5) Check and adjust contacts

- (6) Check monitor indicator lights
- (7) Isolator function and operation
- (8) Thermostat and ventilation system including filter
- (9) Clean cabinet and interior components
- (10) Documentation for intersection inspection
- (C) Cabinet Exterior
 - (1) Condition of surface (Paint, Damage and Graffiti)
 - (2) Condition of locks and handles

K.04.6 Maintenance of Model 170 Traffic Signal Controller Units

The procedure for maintenance and repair of Model 170 Traffic Signal Controller units should be as follows:

- (A) The repair of Model 170 Traffic Signal Controller unit will be performed at one of the three Central Repair Facilities located at District 3, District 4, and District 7. District 3 will provide service to Districts 1, 2, and 10; District 4 will provide service to Districts 5 and 6; District 7 will provide service to Districts 8, 9, 11 and 12.

Each district should have a sufficient number of spare controller units. The number of spare controller units should be sufficient to allow for a number of units being repaired at the Central Repair Facility.

- (B) There are three levels or extents of maintenance of Model 170 controller units.

- (1) Field Level

This is the work that will be done at the intersection. It will be limited to a diagnosis to determine if the controller unit is causing the problem. If the controller unit is determined to be defective, it will be replaced in its entirety and reprogrammed with the operating program module. The diagnostic module will not be used for field level diagnosis.

(2) District Shop Level

This is the work that will be done in each district's signal maintenance shop. It will be limited to a diagnosis of the controller unit using a diagnostic module. No work will be performed on printed circuit boards or power supplies at this level.

The complete controller unit as it came from the field should be sent to the Central Repair Facility with detailed description of the problem and the Special Designation (E-Number) of the location from where it was removed.

(3) Central Repair Facility

Defective controller units will be sent to the assigned repair facility. The Central Repair Facility will make a determination as to when a board or Controller unit should be repaired or salvaged dependent on initial cost, cost of repair and age.

Obsolete units will not be sent to the Central Repair Facility. When a District deems a unit obsolete, the District will replace and dispose of the unit following guidelines from the Property Section.

K.04.7 Pedestrian Signal Indications

When existing WALK-DONT WALK or WALK-WAIT pedestrian signals reach the end of their service life and indications appear dim, they should be replaced with the symbol signal. It is acceptable to mix types of pedestrian signals at an intersection.

Incandescent symbol type pedestrian signals, may be used for Maintenance replacement of all types of pedestrian signals.

K.04.8 Arrow Indications

Use 3-arrow conventional signal face in lieu of PV units with concurrence from Traffic Operations Program or District Traffic Operations unit. Remove any conflicting signing.

Where the secondary indication for left turns is located at the far left, replacement indications should be 3-arrow conventional heads, in lieu of PV units or 8 inches (.2032 meters) red louvered, 8 inches (.2032 meters) yellow louvered, 12 inches (.3048 meters) green units.

K.04.9 Relamping

Traffic Signals should be group relamped every year, except yellow sections may be relamped every two years. If the red indicators have been replaced with LED's the yellow and green sections may be relamped every 2 years.

K.04.10 Traffic Signal Monitors

Monitors shall be shop or field tested for proper operation at least once every 12 months.

Monitor testers shall be shop certified by qualified personnel at Central Repair Facilities at least every 12 months.

K.05 Flashing Beacons

Flashing beacons should be inspected for proper operation at intervals of approximately 60 days.

Flashing beacons should be group relamped every year.

K.06 Ramp Meters

Ramp meters should be checked for damage, proper operation and timing at intervals of approximately 60 days. This check should include the following items:

(A) Field Inspection

- (1) Visual check of indications
- (2) Vehicle head alignment
- (3) Hardware (Hand-hole covers, signs, poles, backplates, etc.)
- (4) Pullbox covers (Broken, missing, and clear of dirt or debris)
- (5) Visual check of service cabinet and equipment locks
- (6) Visual check of loops in roadway (if possible)

(B) Cabinet Interior

- (1) Controller unit indicator lights and display
- (2) Function and timing
- (3) Detector indicator lights and operation
- (4) Check output devices, including interconnect systems
- (5) Thermostat and ventilation system including filter
- (6) Clean cabinet and interior components
- (7) Check documentation (timing sheets, schematics, wiring plans, etc.)

(C) Cabinet Exterior

- (1) Condition of surface (paint, damage, graffiti)
- (2) Condition of locks and handles
- (3) Operation of Police panel switches

K.06.1 Group Relamping

Ramp Meters should be group relamped every 2 years. If the meters are used in limited operation the relamping period can be extended to every 3 years. If the red indicators have been replaced with LED's the yellow and green sections may be group relamped every 4 years.

K.07 Traffic Surveillance Equipment

K.07.1 Changeable Message Signs (CMS)

All types of changeable message signs should be routinely inspected for proper operation at least every 90 days. This check should include the following items:

(A) Field Inspection

- (1) Visual check of indications

- (2) Sign Panel
 - (a) Check interconnect cable connections
 - (b) Test bulb matrix for failures
 - (c) Replace bulbs
- (3) Pullboxes (damage, covers missing or damaged)
- (4) Visual check of service cabinets and locks
- (B) Cabinet Interior
 - (1) Controller and associated units indicator lights
 - (2) Function, timing, and communications (modem)
 - (3) Thermostat and ventilation system including filter
 - (4) Clean cabinet and interior components
 - (5) Check documentation (schematics, wiring plans, etc.)
 - (6) Check operation of all GFI receptacles
 - (7) Check that cables are not stressed
 - (8) Check components mounting hardware securely fastened
 - (9) Remove any dirt and debris
 - (10) Clean dimming sensor
- (C) Cabinet Exterior
 - (1) Condition of surface (paint, damage, graffiti)
 - (2) Condition of locks and handles

Changeable message signs should be relamped as required or as requested by Traffic Operation Branch.

K.07.2 Closed Circuit Television Systems (CCTV)

All closed circuit television systems should be routinely inspected for proper operation every 180 days for proper operation, or as per manufacturers recommendation. Due to possible presence of fiber optic equipment and cabling, or other special equipment, only qualified personnel are to perform routine maintenance inside camera control cabinets. This check should include the following items:

(A) CCTV Camera Assembly:

- (1) Visual check of camera assembly and cables
- (2) Inspection of camera control sub-assemblies for proper operation and function as per manufacturer's instructions.
- (3) Clean enclosure window
- (4) Check humidity indicators
- (5) Camera Control Check enclosure pressure
- (6) Re-charge enclosure pressure (every year)
- (7) Insure pan/tilt drive unit operates freely over entire range of pan/tilt travel

(B) CCTV Receiver:

- (1) Condition of surface (paint, damage, graffiti)
- (2) Condition of locks and handles
- (3) Check mounting screws are securely fastened
- (4) Check cable connections are securely fastened
- (5) Using lap-top computer check the following:
 - (a) Pan/tilt operation from stop to stop
 - (b) Lens zoom in/out
 - (c) Iris auto/manual (adjust iris as necessary)

(C) Video Transmitter:

- (1) Using a power meter, measure and record optical output power
- (2) Check power light is operative
- (3) Check cable connections are secure

(D) Fiber Distribution Unit:

- (1) Clean end of fiber
- (2) Check spare fiber is capped
- (3) Check that fiber is not stressed

(E) Field Equipment Cabinet:

- (1) Check operation of all GFI receptacles
- (2) Check that cables are not stressed
- (3) Check operation of fan
- (4) Check component mounting hardware securely fastened
- (5) Remove any dirt and debris
- (6) Change vent filter

K.07.3 Wrong Way Detection

All wrong way detection systems should be routinely inspected every 60 days for proper operation.

K.07.4 Traffic Operations Centers

All traffic operations center electronic and computerized systems and devices should be routinely inspected for proper operation at intervals consistent with good maintenance practice.

K.07.5 Vehicle Detection Systems

All Vehicle Detection Systems should be routinely inspected for proper operation at intervals consistent with good maintenance practice, depending on the system. Examples of different Vehicle Detection Systems include the following:

- (A) Inductive loop detector
- (B) Magnetometer
- (C) Magnetic detector
- (D) Micro-loop inductive detector
- (E) Remote Traffic Microwave Sensor (RTMS) (used in Districts 4, 7. see operation manual for suggestions)
- (F) Video Image Processing System (VIPS) (to be treated as a CCTV system, see K.07.02.)

K.07.6 Fiber Optic Systems

All fiber optic systems should be routinely inspected for proper operation every 90 days or as per manufacturer's recommendation. Due to specialized equipment and fiber optic cabling only qualified personnel are to perform routine maintenance inside fiber optic cabinets.

- (A) Cabinet Exterior
 - (1) Condition of surface (paint, damage, graffiti)
 - (2) Condition of locks and handles

K.07.7 Highway Advisory Radio (HAR)

All HAR systems should be routinely inspection for proper operation every 90 days. Due to specialized equipment only qualified personnel are to perform routine maintenance inside HAR cabinets.

- (A) Equipment
 - (1) Check range of transmitter signal
 - (2) Check power supply level

- (3) Field equipment cabinet
- (4) Check operation of all GFI receptacles
- (5) Check that cables are not stressed
- (6) Check operation of fan
- (7) Check component mounting hardware securely fastened
- (8) Remove any dirt and debris
- (9) Change vent filter
- (B) Flashing Beacon
 - (1) Check pole mounting hardware
 - (2) Check flasher circuitry
- (C) Field Inspection
 - (1) Check condition of storage batteries, if solar panel is present
 - (2) Contact traffic management center to turn on flashers and check for proper operation
 - (3) Inspect and clean flasher lens, and solar panel if present
 - (4) Inspect advisory sign for damage or graffiti

K.07.8 Communication Hubs

Due to specialized equipment and fiber optic cabling only qualified personnel are to perform routine maintenance as per manufacturer's recommendations.

- (A) Building Exterior
 - (1) Check door locks and handles for damage
 - (2) Check condition of surface for graffiti, damage, etc.

(B) Optical Receiver Rack

- (1) Check power and carrier lights are operative
- (2) Check coax and optical fiber connections are clean and secure
- (3) Using power meter, measure and record optical receive levels
- (4) Check that fibers are not stressed
- (5) Check all unused fiber terminations are capped

(C) Video Multiplexer and Demultiplexer

- (1) Remove and clean each circuit card with a vacuum cleaner and small brush
- (2) Check coax cable connections are secure
- (3) Check optical fiber connections are clean and secure
- (4) Check power supplies' LED indicators are lit
- (5) Using power meter, check and record optical output power
- (6) Check status of all LED indicators on all cards

(D) Channel Bank

- (1) Check mounting screws are securely fastened
- (2) Check cable connections are securely fastened
- (3) Check power supplies' LED indicators are lit
- (4) Check line interface unit (LIU) LED indicators are all lit

(E) DS-1 Optical Modem

- (1) Using power meter, measure and record optical output power
- (2) Using power meter, measure and record optical receive power

- (3) Check power light is operative
- (4) Check data cable connection screws are not loose
- (5) Check optical fiber connection is clean and secure

(F) Video Monitor

- (1) Check all controls operate properly
- (2) Check coax cable connections are secure and not stressed
- (3) Check appropriate termination at rear of unit
- (4) Clean monitor assembly

(G) General

- (1) Check operation of all GFI receptacles
- (2) Check that cables are not stressed
- (3) Check operation of all fan assemblies
- (4) Check component mounting hardware securely fastened
- (5) Remove any dirt and debris
- (6) Check A/C unit is operating properly

K.08 Traffic Counters/Speed Monitors

All traffic count loop detectors should be checked and repaired on notification of malfunction by Traffic Operations Program or District Traffic Operations unit.

K.09 Miscellaneous

K.09.1 Painting

New or existing steel standards and poles for traffic signals should not be painted or repainted.

Participating local agencies may be granted permission to paint steel standards and poles on State highways to match painted standards and poles on their streets or roads.

When existing galvanized signal standards and poles are not repainted, deteriorated paint should be removed or painted over with aluminum paint.

On non-galvanized steel signal standards and poles or on galvanized steel signal standards and poles where the galvanizing is in poor condition, painted surfaces should be maintained as required.

Interior of signal visors, louvers and front faces of back-plates should be painted with flat black paint. Signal heads, signal head mountings, brackets and fittings, outside of visors, pedestrian push button housings, pedestrian signal head housings and visors, and back of back-plates, should be painted with flat black or dark olive green paint.

K.09.2 Distribution of Traffic Signal and Lighting Costs

The cost of maintenance and energy of traffic signals and highway lighting facilities at intersections of County Roads and/or City Streets with a conventional State Highway, should be shared between the agencies concerned in the same ratio as the number of legs in the intersection under each jurisdiction bears to the total number of legs.

In accordance with the above, the cost of maintenance and energy of a traffic signal and intersection lighting on a 4 leg crossing at grade would be shared on a 50-50 basis. Such costs on a "T" or "Y" intersection at grade would be shared on a 33 1/3 - 66 2/3 basis.

The same principle of cost distribution will apply to freeways, except that with interchanges the concept of the overall facility will be used. The participation ratio will be based on the ratio of the number of legs of the respective agencies to the total number of legs of the interchange facility.

In Example "A" (Page K-27) we have a simple diamond interchange, which is a State facility crossing a local facility, with lighting and a traffic signal at the intersection of the local facility and the State ramps. This type of interchange is similar to a 2 quadrant cloverleaf. The cost distribution would be 1/2 local, 1/2 State.

At a "T" type interchange it would be 1/3 local, 2/3 State.

Frontage roads that may be adjacent to the freeway, and intersect only with the local road, should not be considered a part of the interchange facility. These intersections are local and 100 percent the responsibility of the local agency.

Some frontage roads are integrated with the interchange such as the case where the freeway ramps connect to the frontage road before connecting to the local road as shown on Example "B" (Page K-27). Usually, in this case, the short piece of frontage road between the ramp terminal and intersecting local road should be considered as belonging to the local agency, even though it is used to complete the interchange with the local road. The frontage roads approaching the interchange cannot be considered local legs of the interchange and should not be counted as local legs. In general, the freeway will be interchanging with the local road or street and not the frontage roads constructed strictly for property access. An isolated ramp Example "E" (Page K-28) cannot be considered an interchange, and we must then use the concept of an intersection at grade. The participation ratio of Example "E" would then be 1/3 State and 2/3 Local.

Example "H" (Page K-29) shows a State highway intersecting a City/County street or road and a driveway. The cost distribution would be shared on a 50-50 basis between the State and City/County. City/County is responsible for the driveway leg. Costs, to be shared, are accrued in those areas in the immediate vicinity of the intersections considered to be within the interchange.

These are intersections of the various ramps and/or frontage roads with city streets and county roads.

An alternate method of sharing maintenance and energy costs would be to have the Local Agency bear 100 percent of the energy costs and the State bear 100 percent of the maintenance costs. There would be no billing to either agency. Participation in this method of sharing costs is by request of the Local Agency.

See Pages K-27, K-28 and K-29 for typical conditions.

While these are typical examples to be used as a guide, there may be extenuating circumstances that may allow further consideration based on local conditions.

K.09.3 Traffic Signal Operation During a Power Outage

The following procedures will be followed in the event of a utility company power outage:

- (A) An unplanned utility company power outage is usually caused by severe weather conditions or system failures such as shorted transformers or downed poles or lines

This type of outage is unpredictable and usually for an unknown period of time. It will be Caltrans general policy not to provide standby electrical power or stop signs at traffic signals during an unplanned utility company power outage as described above.

- (B) A utility company may make a planned power shutdown to make repairs on their facilities and request standby power or stop signs from Caltrans when it affects our traffic signals.

It will be Caltrans general policy, upon 72 hours notice, to provide standby power or stop signs where possible, consistent with availability of equipment and personnel.

This is Caltrans' general policy on providing backup control at traffic signals during power outages. In power outages, as in any other emergency, it is the function of the California Highway Patrol and the local police to provide immediate short-term traffic control. Generally, the CHP will provide traffic control in unincorporated areas and the local police will provide those services in incorporated areas.

As with any general policy, there may be extenuating circumstances that require exceptions to this policy. These exceptions may be approved by the District Division Chief of Maintenance.

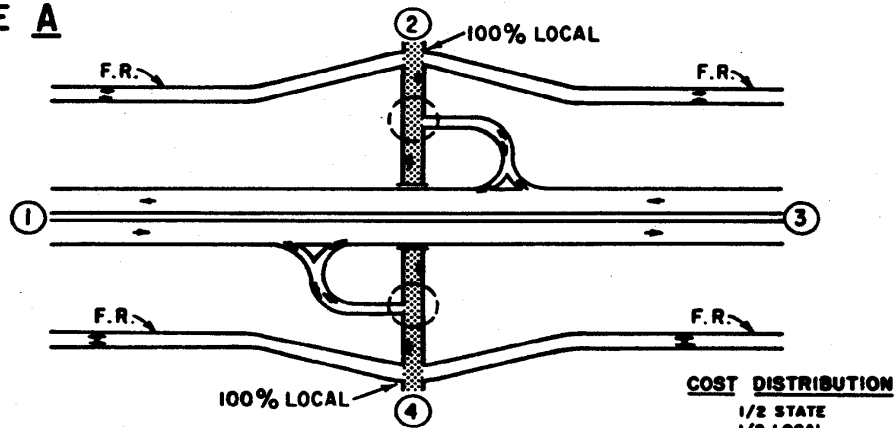
It is our intent to cooperate as fully as possible with the California Highway Patrol and the local police, consistent with our resources limitations. Contact should be made with the appropriate law enforcement offices, discuss our capabilities and establish the appropriate Caltrans contact person for CHP and the local police then requesting our assistance.

K.09.4 Safety Precautions

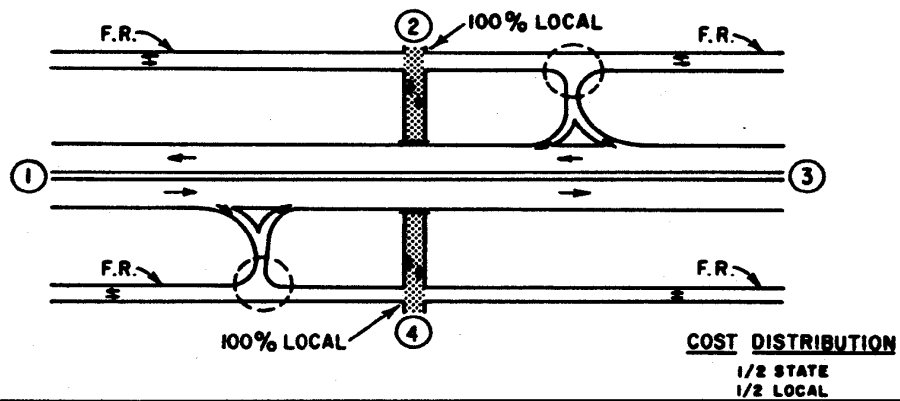
It is the responsibility of all Caltrans highway electrical maintenance managers, supervisors, and employees to understand and follow the applicable codes of safe practices. All pertinent Departmental Maintenance Manual sections, Departmental Safety Manual sections, Departmental Policy and Procedure Memoranda, Safety Orders, Maintenance Code of Safe Practices Manual, and District instructions relating to employee safety and health are to be followed.

**DISTRIBUTION OF SIGNAL AND LIGHTING
COSTS ON FREEWAYS**

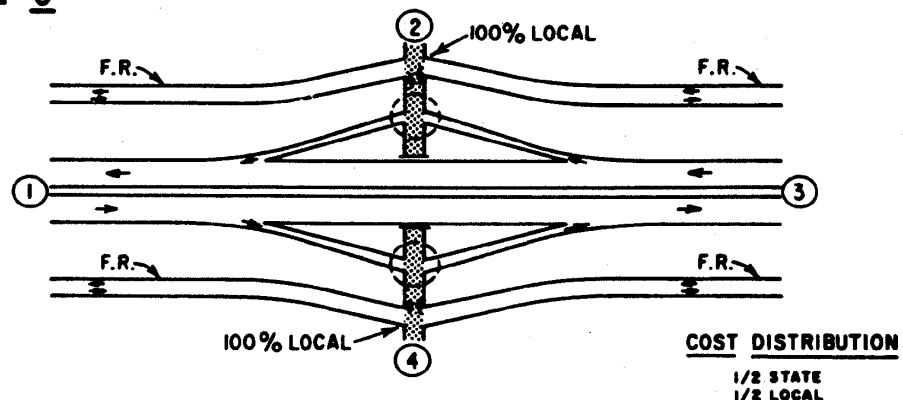
EXAMPLE A



EXAMPLE B

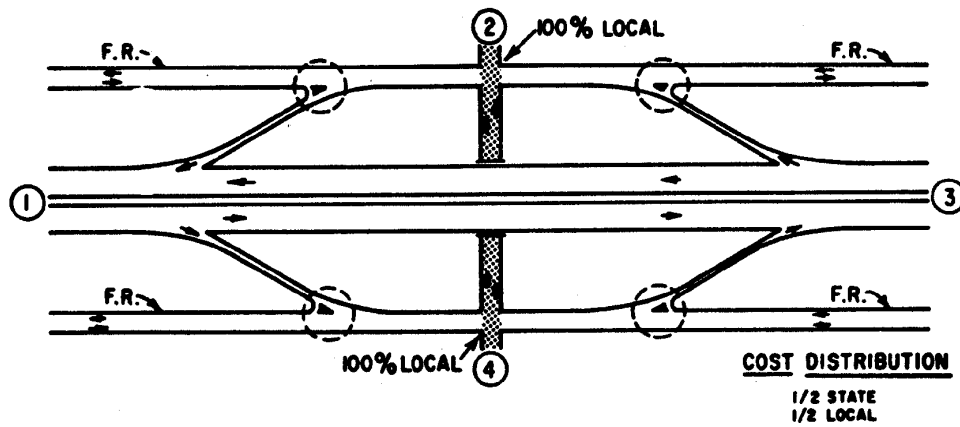


EXAMPLE C

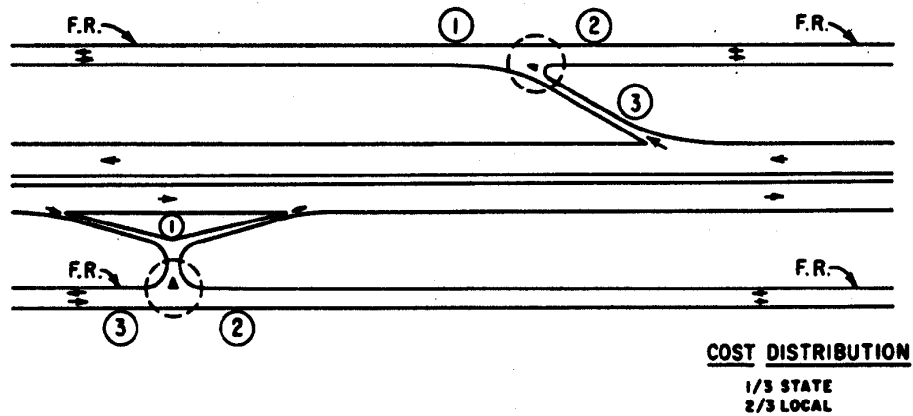


**DISTRIBUTION OF SIGNAL AND LIGHTING
COSTS ON FREEWAYS**

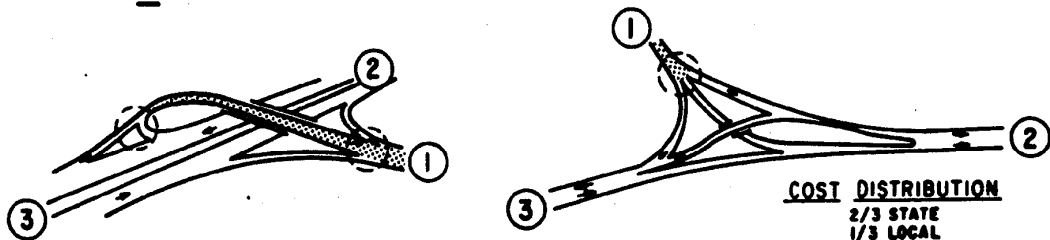
EXAMPLE D



EXAMPLE E

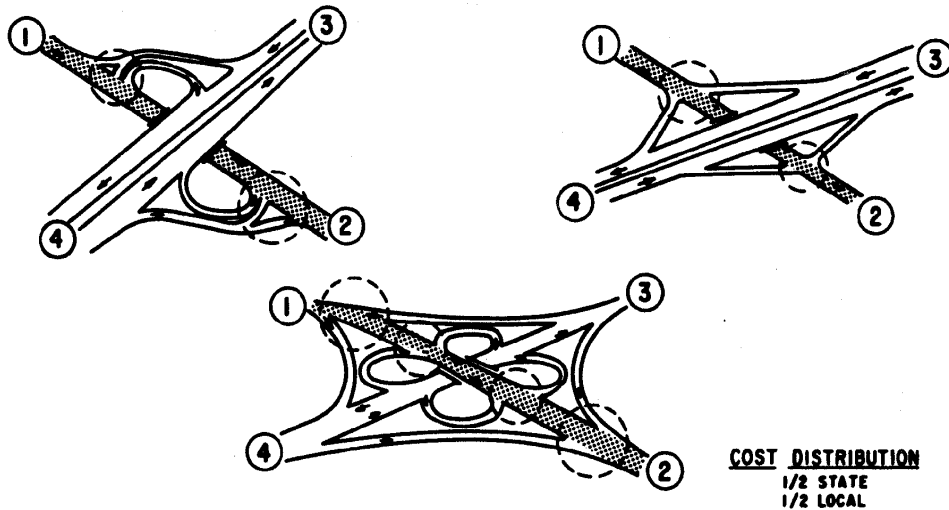


EXAMPLE F

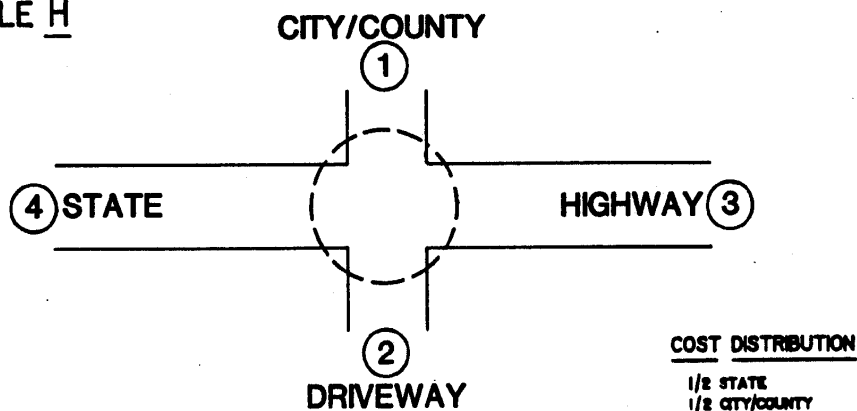


**DISTRIBUTION OF SIGNAL AND LIGHTING
COSTS ON FREEWAYS**

EXAMPLE G



EXAMPLE H



NOTE: RATIO OF PARTICIPATION IS BASED ON NUMBER OF LEGS AS NUMBERED.

——— -STATE HIGHWAY

——— -COUNTY ROAD OR CITY STREET

——— F.R. ——— -FRONTAGE ROAD

○ -APPROX. AREA OF INTERSECTION WHEREIN LIGHTING AND
SIGNAL MAINTENANCE COSTS, TO BE SHARED, ARE ACCURED